Visual Mapping for Medical Concepts

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ABSTRACT

Concept relationships are traditionally defined in human-generated vocabulary lists such as the Medical Subject Headings (MeSH). This poster describes a prototype system that automatically generates concept relationships from the medical literature. The system is directly connected to the PUBMED search engine. For any given medical concept, the system will generate two styles of visual maps from MEDLINE in real time. Users can use the maps to explore concept relationships or construct better search queries interactively.

INTRODUCTION

Exploring concept relationships is a common task in accessing medical information and for understanding medical concepts. It's not easy, for example, for many people to realize that "allergy" in MEDLINE is indexed under "Hypersensitivity." It is much more difficult for people to recall the various terms associated with "Allergy," such as "Allergens," "Asthma," "Cytokines," "Eosinophils," and "Occupational Diseases." However, if these and other related terms are presented in a visual form showing their relationships, most people will recognize these terms and gain a better understanding of how these terms are related to their querying term: "allergy."

We are implementing and testing a research prototype, called ConceptLink, that will visualize associative term relationships for any given medical term or concept. ConceptLink is a web-based interactive interface that directly links to the National Library of Medicine's (NLM) PUBMED search engine. It utilizes NLM's Medical Subject Headings (MeSH) and the Unified Medical Language System (UMLS) to derive associative concept relationships. When the user searches for a term through ConceptLink, visual concept maps for the term will be generated instantly. These maps allow the user to explore the concept relationships and construct Boolean queries using drag-and-drop techniques.

SYSTEM DESCRIPTION

ConceptLink includes three major components: a front end, a backend, and a set of visualization procedures. The front end is an interactive interface implemented as a Java applet. The backend includes a series of Java servlet applications that process requests from the front end and redirect the requests to PUBMED or UMLS servers. The backend also processes the results from PUBMED searches and prepares data for use with the visualization procedures. The visualization procedures implement several visualization algorithms, including Path Finder Network (PFNET, [1]) and Kohonen Self-organizing mapping algorithm (SOM, [2]).

When the user searches for a term, ConceptLink first checks if the term is a MeSH descriptor. If it is, the system will use the MeSH term co-occurrence table in UMLS to identify the top 25 terms that co-occur most often with the search term. If the term is not a MeSH descriptor, ConceptLink will conduct a PUBMED search and list those MeSH terms occurring most often in the search results. The user can then select any term on the list for mapping.

Figure 1 is a PFNET map for the search term "allergy". The PFNET map shows related terms in links and clusters. It should be emphasized that this map is generated automatically in real time; it reveals how these terms are related in the entire MEDLINE literature database. Additional maps will be displayed during the conference, and the system will also be demonstrated live.
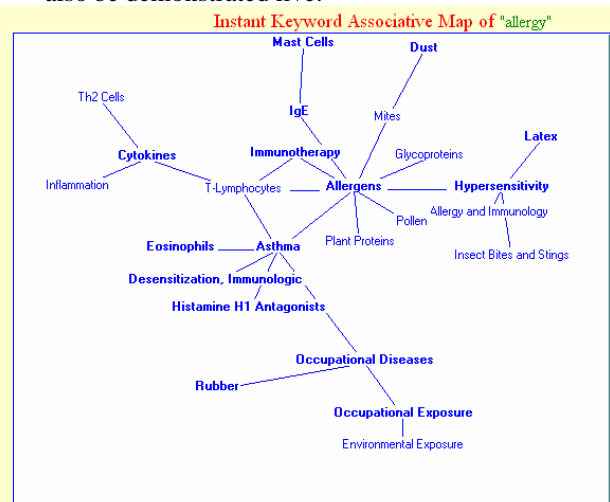

Figure 1. An automatically generated concept map for "allergy"

REFERENCES

[1] Schvaneveldt, Roger W., ed. (1990). Pathfinder Associative Networks. Ablex.
[2] Kohonen, T. (2001). Self-Organizing Maps. Third Extended Edition, Springer, Berlin.